Maughs (G. M. B.)

MENSTRUATION;

OR, THE

MENSTRUAL FLOW:

AN

EPIPHENOMENON OF OVULATION.

AN

ARGUMENTAL TREATISE, READ BEFORE THE ST. LOUIS MEDICAL SOCIETY, ON THE QUESTION: IS MENSTRUATION OVULATION?

BY

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D O N O T R E M O V E T H I S S L I P

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TREATISE.

Menstruation is a complex phenomenon connected with, and dependent upon, ovulation; and the menstrual flow is not a necessary, but very general, accompaniment.

The principal act of menstruation—that which gives it its true importance in the animal economy—is the periodical maturition and discharge of ova, and this act in the human female corresponds with the oestrual period in the inferior mammalia; oestruation is menstruation in these animals.

We have thus stated this question, not for the purpose of making two distinct propositions, but to give more fully the matter of controversy before the Society.

Our first argument in support of the view here enunciated, is that furnished us by the abnormal condition of the ovaries and uterus—1st. It is found, when the uterus is present, but the ovaries absent or atrophied, there is no development of sex, no expansion of the pelvis, no enlargement of the mammæ, no soft contour of person characteristic of woman, no menstruation or menstrual molimen, no attachment for the opposite sex, no woman's voice; but, in de-

spite of the fact that she possesses both uterus and vagina, she either remains a child or approaches, morally and physically, more nearly the male than the female. In proof of this, a case is given by Dr. Pears (Phil. Trans. 1805, Vol. XCV, p. 223), in which the subject, a female aged 23, at her death "she had still the appearance of a child, with no indications of puberty, either in mind or body. The pelvis was undeveloped, the mammæ and nipples not larger than in the male, and the menses had never appeared. On post-mortem examination it was found that the uterus, though normal in form, had not increased in size beyond the infant state, and (which was the cause of the whole of this absence of development) the ovaries were so indistinct as rather to show the rudiments of what ought to have formed them than any part of their normal structure." Again, the same condition was found by Dr. Roberts with the castrated women of India. "The individuals he examined were about 25 years old, large size, quite muscular, and in full health; they had no mammæ, no nipple, no hair on the pubis, the orifice of the vagina was completely closed, and the arch of the pubis so narrow that the descending rami of the pubis of the opposite sides came almost in contact. The whole pubic region showed no deposit of fat, and the nates were not more developed than in males, while the rest of the body had the usual quantity of fat. *There was no trace of menstrual secretion, nor any discharge vicarious to it,* no sexual appetite."

Were other proof of the dependence of "sexual development upon the ovaries necessary, we might cite the innumerable direct experiments upon the pig, calf, rabbit, &c., where it is found, after the removal of the ovaries in the young state, the sexual characters are never developed.

2d. When there is no congenital defect, and puberty is fully established and menstruation regular, if the ovaries be removed or destroyed by disease, both menstruation and the menstrual molimen immediately cease. There is no longer a periodical excitation—no oestrum veneris—and the female, whether human or of the inferior animals, loses the sexual character, more or less approaching that of the male. This is well illustrated in the case of a young woman, 23 years of age, both of whose ovaries were removed by Dr. Percival Pott on account of their forming hernial tumors, which incapacitated her for work. The woman perfectly recovered; *but the menstruation, which before had occurred with the greatest regularity, never afterward appeared;* the breasts, which had been voluminous, subsided; she also became thinner, and assumed a more masculine appearance." Vanlevier mentions a case in which "menstruation suddenly ceased in a young woman in good health. No disease followed; but soon afterward a perfect beard began to grow upon her face." Here, there can be no doubt, the cause of such change was atrophy of the ovaries. "Again, in women who have passed their menstrual and child-bearing pe-

riod of life, and in whom, consequently," says Dr. Simpson, "the functions, and often the healthy structure of the ovaries, are lost or destroyed, we have frequently an opportunity of observing a similar tendency toward an assumption of some of the peculiarities of the male—an increase of hair often appears upon the face, the mammæ diminish in size, the voice becomes stronger and deeper toned, the elegance of the female form and contour of body is lost, and frequently the mind exhibits a more determined and masculine cast." Direct experiments upon females of the lower class show that, after the removal of the ovaries, there is no longer a periodical excitation of the reproductive organs, no return of the oestrual period; and the female, losing her sexual peculiarities, approaches more or less closely those of the male.

In the female of the lower animals the same peculiarity is seen to take place after the loss, by age, of the functional activity of the ovaries, which we have seen in the human female, for in the loss of the ovaries by removal or disease, they lose their sexual peculiarities. In some horns grow, the neck thickens, and otherwise they obtain a virilescent type, until they can scarcely be said to differ in general appearance from the male. The same is true of birds, which have lost the functional activity of their ovaries from old age. These are observed to assume more or less perfectly the plumage, voice, and even the habits of the male. The argument here is, that

the ovaries give to the female her sexual peculiarities. The functional activity of the ovaries in the human female is known as menstruation; in the female of the inferior animals it is oestruation; in both it is ovulation. And, as ovulation is an ovarian, and not uterine, action, therefore the true menstrual act is in the ovaries, and not with the uterus; consequently maturation and discharge of Graffian vesicles constitute the true menstrual and oestrual epoch, and not the discharge of blood or mucus; and, in incontrovertible proof of this it is found that,

3d. When the ovaries are present, though both vagina and uterus be absent, all the conditions of puberty are normally developed, the external menstrual flow only being absent; with all the physical and moral characteristics of her sex, she may even marry to awake from her dream of love and hope by the fearful discovery of physical defects of which she was not aware, was indeed conscious, by her organic impulses, did not exist. In positive proof of this, a young girl, 21 years of age, who had menstruated twice, and for three days at a time, had been for a long time violently in love with an officer, finally gave herself up completely to his desires; after several attempts, renewed each time with much ardor, but which each time proved fruitless, the young man finally discovered and acquainted her with the fact that she was not formed like other women, and advised her to consult a physician. She was examined by the learned French Accoucheur, P. Cazeaux,

and Thirbal, from whom we learn the following facts: "The countenance, stature and development of the limbs and breasts differed in no respect from what is usual in young girls of her age. Her general health had always been good. In the month of May last her courses appeared for the first time, and continued for three days; she had, however, several days before, experienced symptoms of uterine congestion. In the month of July they showed themselves again, for the last time. The attempts of her lover were twice followed by a considerable flow of blood."

"The mons veneris is completely destitute of hair, with which it is usually covered; the ovaries presented on either side at Inguinal rings." "The vulvar opening was bounded by the greater and lesser labia, but both were much less developed than usual. The finger, which could be introduced only with difficulty into the vulvar orifice, was arrested at the depth of three-quarters of an inch, so that it was only by forcing up the extremity of the vagina that the first phalanx could be made to enter that canal."

Upon further and careful examination they found that the lowest extremity only of the vagina was present; that the upper four-fifths of that canal and the uterus were absent; *that the hypogastric and lumbar pains which were experienced regularly, and almost monthly, were the expression of periodical ovarian operations;* that the blood of the menses, which had appeared twice in this young girl, had its origin from

the mucous membrane of the vagina, and was, of course, a misplacement of the menstrual flux.

Now, here is a case, given by authorities that do not permit us to suppose any mistake, in which the periodical menstrual molimen occurred regularly, and in two instances the entire completion of the menstrual act, even to its epi-phenomenon the menstrual flux, without any uterus, and only the vulvar orifice of the vagina; therefore, the uterus and vagina are not necessary for the complete accomplishment of menstruation, and consequently the uterus is not the *cause* of menstruation. And, as in all the world there can not be found a case where this act was regularly and completely performed in a healthy female without ovaries; and, as from the very nature of the act, such a thing is impossible, therefore it follows, as an irresistible conclusion, that the *cause* of menstruation, as well as the true menstrual act, is in the ovaries—ovulation. Again, direct experiments on the lower animals prove that, if the uterus and upper portion of the vagina be removed, but the ovaries and tubes be left intact, the periodical orgasm, analogous in these animals to menstruation in the human female, returns with great regularity, while such periodical orgasm is always immediately and forever prevented by removal of the ovaries, though the uterus and vagina remain; therefore, the cause of oestruation—the essential act analogous to menstruation in the human female—is in the ovaries—is ovulation.

From these facts we infer, with but little fear of successful contradiction, that woman is what she is, not because of her womb, as was formerly supposed, but on account of her ovaries; and that the efficient cause of the menstrual molimen and oestruation is in the ovaries. That true menstruation is the periodical changes taking place in the ovaries, while the external flow, so-called menstruation, is only a concomitant, a result, an external sign, a secondary phenomenon, and not absolutely necessary to the accomplishment of the act or purposes of menstruation. And this derives positive proof in the fact that many women have become mothers, even the second and third time, without ever having had a menstrual flow.

Our second argument is drawn from the normal, anatomical structure and known physiological action of the ovaries.

The ovaries of all animals are egg-bearing organs, and, from the slug to the human female, much the same in structure, consisting of parenchyma or stroma, and vesicles containing ovules. In the human female they are two small, smooth, elastic bodies, constituted of special tunics and stroma containing ova. The outer or peritoneal coat covers all but the inferior border, while the more internal albugineous coat closely invests the stroma, giving, by its firmness, shape to the organ. The stroma is a greyish, red substance of moderate firmness and consistence, composed of nucleated, elastic, firm, fibrous, con-

nective tissues, in the meshes of which, reposing as upon an elastic, velvety bed, are a great many Graffian vesicles, from 1-4 to three lines in size, according to their development. Each Graffian follicle contains an ovum of microscopical size, a large cell, and, though but a cell, pregnant when vitalized, dynamically energized, by contact with the sperm cell, with all the phenomena of special differentiated organic life, as manifested in the phenomenal existence of the individual or the race. These Graffian vesicles, like other tissues of the body, are subject to constant changes—cell changes—from infancy to old age, but can be said to have a physiological existence, physiological activity or function only during the child-bearing period, at which time from 40 to 200 or 300 are constantly present, differing, however, greatly in size, those deeply seated in the stroma fading into mere microscopical dots, while those near the upper surface—where the ovary is embraced by the fimbriated extremity of the Follopian tube during the erethism of coitus, or the orgasm of the menstrual epoch, which their maturation produces—measure several lines in diameter; after the child-bearing period they disappear until not more than 4 or 5, or even none at all, exist. The mistake has occurred of confounding the structural changes that take place in these vesicles during infancy and childhood with the physiological changes that occur at a later period. The former are transitional changes only, preparatory to the forma-

tion of the true Graffian vesicle, by and through which changes, it may be, it receives its dynamical energy, whereby it represents all the female furnishes in the reproduction of the species, while its subsequent changes, or physiological activity, are the manifestations of such dynamical energy seeking that harmony of relations whereby the life of the individual is produced.

Physiologically then these vesicles remain during infancy and childhood in an undeveloped state, but rapidly enlarge and approach the surface towards puberty, or—as they enlarge—mature, puberty approaches *pari passu*. At puberty one or more of these vesicles can be seen and felt projecting the ovarian surface, and at, or during, each catamenial period a Graffian vesicle ruptures, discharging an ovum, while the hemorrhage which takes place from its highly vascular walls into the follicular sac forms a corpus luteum. Now, it matters not at how early an age, if at five, or seven, or nine years, this Graffian vesicle matures, ruptures and discharges its ovum, the child will then and there menstruate and rapidly develop into womanhood. This act is indeed the capital part of the menstrual epoch, and, with or without the menstrual flow, the female is capable at that moment, regardless of age or size, of conceiving ---has indeed, in this act, furnished her contribution towards the reproduction of the species. Nor will the woman have the resultant menstrual flow, or be capable of conceiving even at twenty-five years of age,

should this maturation and rupture of the vesicle be delayed; and during the child bearing life of the female this maturation and rupture of vesicles takes place with periodical certainty and regularity, and forms its corpus luteum regardless of coition, that is, whether or not the female has connection with the male.

From these facts again we infer, if indeed they are not themselves demonstrations, that menstruation is ovulation, that this ovulation, or egg laying, is the law of the animal economy, the menstrual flow a concomitant, and that the periodical orgasm has its origin, not in the uterus, but in the ovaries. And hence the menstrual flow is not a necessary, but very general resultant phenomenon of the menstrual period in the human female, announcing by its presence the fullness, the regularity and perfectibility with which the organs respond to the ovarian orgasm.

Our third argument is, that the catamenial period is not peculiar to the human female, but corresponds to the oestrual period in the lower female mammalia. And in these, direct experiments demonstrate such periods to be accompanied, caused, produced by the maturation and discharge of an ovum or ova. The number of these corresponding to the number of young the animal produces at a time. Now, as the connection with and dependence of oestruation upon the maturation and discharge of ova in the lower animals is placed beyond doubt or controversy, by the observation and numerous demonstrations of

direct experiment, in order that this argument be conclusive, it is only necessary to show the analogy between the oestrual period of the inferior animals and the menstrual period in the human female.

1st. In both this period is periodical, announcing both the aptitude and the season for conception.

In support of this proposition we will first quote Dr. Montgomery, who, at pages 386 and 387 of his work on Pregnancy says: "There is now abundant evidence to satisfy us that at each return of menstruation in women, and of oestruation in the lower animals, a state of greatly exalted action is set up in the ovaries, which is more particularly concentrated on one or more of the Graffian vesicles, in consequence of which their coats are rendered intensely vascular, they become larger, more prominent, and, in many instances, burst and discharge the ovum." "That this is a time at which the sexual emotions and generative nisus or propensity are more than ordinarily active, does not, I believe, admit of a doubt; and at this time, or very soon after it, conception is most apt to occur, is, I think, equally proved." In support of this he gives the well-known case where Fernel, when consulted by Henry II. of France as to the best means of rendering his Queen, Catherine de Medicis, fruitful, advised him to visit her only immediately *after* the cessation of the menstrual discharge. The adoption of this advice was attended with success, and the queen, after years of disappointment, gave birth to a son.

Again, Cazeau says, "Admitting the incontestible analogy between the symptoms of heat and menstruation, it will be sufficient to prove that the former is always connected in animals with ovarian evolution, and this fact is proved by certain experiments of Coste and others." It is not, however, necessary to multiply proofs to establish what cannot be denied, that in the inferior animals this is the season of aptitude for conception, and in the human female that such is the case has long been admitted by most eminent accoucheurs. M. Nægele says, "Acting upon this he has relieved many cases of barrenness by advising copulation immediately after the menstrual flow."

2d. In both there is congestion and heat of the reproductive organs, ovaries, Fallopian tubes, uterus and vagina, announced by an increased discharge of mucus, often, more or less, mixed with blood.

This proposition will not, I believe, be denied by any one.

3d. In both this periodical irritation is found to depend upon the integrity of the ovaries.

This has been proved in a previous argument.

4. In both the external flow is found to be a concomitant only, and to agree in their essential features, viz., in woman it is blood mixed with mucus, in the inferior animals it is mucus, often more or less mixed with blood. In this it is seen that the remarked bloody discharge is an accessory feature, belonging not to menstruation as a menstrual act, but to the

human female more especially, and not absolutely or necessarily to her, as the act can be, and undeniably often is, successfully accomplished without any such discharge.

Now, as like causes produce like effects, or as like effects flow from the same or like causes, and as the cause in the inferior animals is experimentally demonstrated to be in the ovaries, ovulation, therefore we are compelled to believe that in the human female the cause is in the ovaries---the act ovulation.

Our fourth argument is, that the theory of ovulation accounts for all the phenomena, which no other theory does. Now, by the laws of thought we are not permitted to accept a law incapable of accounting for all the phenomena under it when we are in possession of one fully capable of doing so. Nor are we permitted to multiply hypotheses, or hypothecate causes, when one known accounts for all the phenomena. Now, as stated, and as will be fully shown the theory of ovulation does account for all the phenomena. Therefore, by an accepted principle in philosophy, we are compelled to accept it as the efficient as well as the sufficient reason.

Our fifth argument is, that this opinion is held as an admitted fact by an overwhelmning majority (almost unanimously) of those whose means of observation and eminent scientific attainments most entitle their opinions to respect. In this class, among a multitude of others, may be mentioned

Churchill, Bennet, R. Lee, Montgomery, Wagner, Hodge, Meigs, Miller, Dalton, Dunglison, Todd and Bowman, Bedford, T. Smith Ecker, Janker, Ritchie, Argante, Hirtle, Locatilli, Pouchet, Bischoff, Coste, H. Meckel, Raciborski, Simpson, Cazeau and Kolliker.

Our sixth argument is, that the connection with, and dependence of menstruation upon, the maturation and discharge of a Graffian vesicle in the human female has been demonstrated by the direct observations of a sufficient number of able and scientific trustworthy men to place it beyond reasonable doubt or successful controversy; and, in accordance with this, the theory of ovulation has taken place with the admitted and fixed facts of a scientific and progressive age.

But, as this argument is, if sustained, like that presented by the morbid anatomy of the parts, conclusive, we shall enter at some length in its support.

We first quote Mr. Gairwood, who says, "The ovary of a female who has never menstruated is a soft, pulpy mass, oval in shape, with a regular defined outline, and a smooth, polished, glistening surface. In a female who has menstruated for a number of years the surface is much changed—deep corrugations have destroyed its smooth, oval form, while a mass of cicatrices, irregular and ill-defined, mark and mar its surface;" and this fact I have often observed, and hold myself ready to demonstrate at any time.

His first case was a girl, 9 years of age, who died

of Scarlatina. On one of the ovaries was found a Graffian vesicle, enlarged, projecting immediately under the albugineous coat, causing a nodular projection of the ovarian surface. She had not menstruated; had, however, she lived a short time that she would have done so, and that, instead of this enlarged Graffian vesicle, the ovary would have presented a corpus luteum, Mr. Gairwood thinks certain, and subsequent facts reduce this opinion to at least a moral certainty.

His second case—A girl died six hours after the appearance of the menses. On the left ovary there was an oval cavity, large enough to admit a tare, and, no doubt, left by the recent escape of an ovule. Its margin was irregular and flocular, and, as well as the walls, of a deep, red color. This female had menstruated for years, and the ovaries were scarred with cicatrices.

Case third—Emma Bull died with dropsy. Two years previously she had menstruated an only time. The ovaries were marked with here and there an enlarged Graffian vesicle, approaching near the surface. The right ovary presented no scar, but on the left a single cicatrix was well defined.

Case fourth—A young woman died who was known to have menstruated three times only. On one ovary were two well-defined cicatrices, and one on the other.

Case fifth—In a young woman who had menstru-

ated six times, were found five well-defined cicatrices, the sixth not so distinct.

Case sixth—In a young woman, sixteen years of age, who had been regular two years previous to her sudden death, twenty-two cicatrices were counted. The same correspondence was found in numerous other cases, from which Mr. Gairwood concludes the number of menstrual periods correspond with the number of ovulations, and this independent of sexual connections, existing alike in the virgin and married female — the maturation and bursting of the follicle and formation of a corpus luteum not requiring for its production the stimulus of coition, but connected with the menstrual flow as cause and effect.

Now, it is not contended by us that in all cases where the woman has menstruated for a number of years, a number of cicatrices exactly corresponding to the number of menstrual epochs can always be found. We know that even those cicatrices, following the more persistent corpora lutea of pregnancy, are eventually rendered indistinct, are obliterated by absorption, much more so with these. The argument is, that they are *always formed*, not that they *exist always*. But they are often sufficiently persistent to mark the number of menstruations for the several last periods, and ever after corrugate, mar, the previously smooth surface of the ovaries.

Another highly creditable witness, M. Gendrin, states that his observations convince him that, during the whole period of a woman's menstrual life,

there is a constantly successive development of ovula and vesicles in the ovaries, and that, at each menstrual period, a vesicle, having reached the surface of the ovary, becomes the focus of a peculiar organic action in which all the reproductive organs participate. The *result* of this orgasm is, the vesicle ruptures and the ovum escapes. This rupture takes place regularly, at stated intervals; the result is menstruation or the menstrual flow." M. Gendrin, then, gives the maturation and rupture of the vesicle as the *cause*, the flow the *result*.

Dr. Negrier, Professor of Midwifery at Angers, fully endorses the views of M. Gendrin, and says that, so early as 1830, he held these views, and had repeatedly shown to his pupils the surface development of the ova to their final rupture, as well as the connection with and dependence of menstruation thereupon.

Our next authority is T. L. G. Bischoff, Professor of Physiology at Giessens, and of whose labors the greatest Embryologist of this or any other age, L. Agassiz, says: "Never were experiments upon this long-vexed question conducted with more *skill and success* to *establish the facts beyond question*, and *never were the physiological views derived from them deduced with more accuracy and precision. It is a model in this kind of experiments.*" Those experiments of Bischoff which Agassiz says "placed the matter beyond question," were numerous, and made upon the inferior female mammalia, such as the cow, the bitch, rabbit,

rats and mice, and on these animals were so varied as to prove—1st, that the period of oestruation is the period of ovulation; 2d, that the oestrual period was produced, *caused*, by the periodical maturation and discharge of ova; and, 3d, that this maturation and discharge of ova was independent of coitus: and all these facts they did establish beyond a reasonable doubt. He says: "Now from all these observations, it is quite certain that the ova in the mammalia, in the time of heat, no coition taking place, are detached from the ovary, enter the tube and perish there, and that corpora lutea are formed in the ovaries just as though coition and fecundation had been effected."

"If, by the preceding experiments, it has been proved in regard to the mammalia that their genesis and propagation is, *primo loco*, dependent upon a spontaneous, periodic formation and maturation of ova, we are, by analogy, led to suppose the same in regard to the human female, but proofs, at least indirect ones, are not wanting."

"Menstruation in the human female has, for a long time, been compared to the heat in animals. This view has been received at all times by most intelligent physicians and naturalists, though it has been combatted by men not less eminent." These opponents had not then the irresistible proofs which Bischoff furnishes, that in both cases ovulation was the *cause* of the phenomena.

The "greatest objection urged to this view," says Bischoff, by Burdach, whom he considers its great-

est opponent, is derived from the then state of the sexual appetite and the admission of coition. "The lower animals will copulate only in time of heat, while man has ever felt himself repelled at the period of menstruation." If this were actually true, then, in my opinion, an essential difference would be established; but attentive observers have before now remarked, and have confirmed it, such a difference does by no means exist; for the female of the lower animals evinces a state of impaired health in the beginning of the heat, and does not admit the male—it is only when the phenomena of heat have been to a certain degree developed that she seeks coition. Now, it is known that with the human female, after menstruation is over, a feeling of improved health exists, and the sexual appetite is particularly manifested. The most complete correspondence is therefore found in this respect."

"Moreover, *all intelligent anatomists, physiologists and physicians have for a long time been convinced that the cause of menstruation*, as well as of sexual instinct, *is in the ovaries;* and that the *uterus*, on the contrary, though by it the sexual apparatuses in the di ferent classes and genera of animals have been typified, is, *in this relation, quite* of secondary importance. Numerous cases in pathology the most diverse in character, and numerous deviations from the normal type (malformation), concur entirely in this respect."

"Quite recently direct anatomical proofs of these statements have been furnished. *It now does not*

admit of a doubt that the ovary, at the time of each menstruation, is in a state of great excitement---that a Graffian vesicle is considerably developed---bursts, and a corpus luteum is formed in its place. The investigations of Robert Lee, Bateman, W. Jones, Negrier, Gendrin, Raciborski and Pouchet remove from this question *every vestige of a doubt.* I myself have had occasion four times to make examination bearing on this point, all confirmatory of the same fact."

"Finally comes the long-known fact, that females conceive most certainly immediately after menstruation, and examples are not wanting where this occurred with some *only* at the time of menstruation. Prof. Naegele has told me that he has never been deceived in regular cases when reckoning nine months and eight days from the last period, and that he had removed cases of barrenness by advising copulation immediately after or even during the flow."

"In the human female, during menstrual life, the maturation and discharge of an ovarian ovule takes place every four weeks, accompanied by a contemporaneous discharge of blood. This periodical maturation of an ovule is the primary and principal condition on which conception and pregnancy depend; at no other period is it possible."

It is seen here that this accurate experimentor does not make the well-being of the fœtus in the least dependent upon the periodical determination of blood to the uterus, which excess, after conception,

is turned to the feeding of the fœtus (as still taught by some). Such engorgement is a result, and, with its resultant flow, epiphenomenal.

Again: "It appears that the discharge in the uterus begins while the ovule is still in the Graffian vesicle, and that it is not detached till the cessation of the flow, while in the tube it is probably capable of being fecundated for several days if coition supervene. How long? This can only be settled by direct observations, which are as yet altogether wanting. Thus much, however, I believe, may be received as certain—that fecundation must take place in the tubes (that is, before the ovum has arrived at the uterus), because here, very probably, development begins."

"The ovum of the rabbit remains in the tube three, that of the rodentia four or five, and that of the bitch eight or ten days, as far as we know, then we may suppose that the human ovum still exists for from eight to twelve days after its discharge from the ovary, and, therefore, that for eight or twelve days after the menstrual flow has ceased the ovum is susceptible of fecundation."

"I have often been asked if conception is dependent on menstruation, and this on the maturation of an ovum, how is it possible that females conceive, never having menstruated? I answered to this by simply stating that, though the discharge of blood is a normal and easily cognizable symptom of the maturation of an ovum, the latter is, nevertheless,

not essentially dependent on it, as a single glance at the animal kingdom proves. This periodic maturation of ova is there seen, both with, and oftener without, such discharge of blood. Menstruation (the menstrual flow) then is, in the human female, an entirely normal and important, though by no means essential, but rather accidental symptom of ovulation. It may be wanting and yet ova mature, and be, therefore, susceptible of development and fecundation. If the human female menstruated but once or twice a year, it would long ago have been remarked that these were the only periods at which conception was possible; menstruation would long ago have been recognized as perfectly analogous to the heat in animals, even though the most important element, *i. e.*, the maturation of the ovum, had not been discovered. As, on the one hand, menstruation occurs every four weeks, and, as conception is so often possible, it was not easy to fix the limits within which it was to be restricted without further observation; and, on the other hand, menstruation passes by so often without its purposes, *i. e.*, conception being attained, it was quite natural that attention should be directed more toward the former than to the dependence of the latter upon it. In animals just the reverse relation opposes a correct appreciation of the analogy between the heat and menstruation. With them the heat occrs either very rarely, once or twice a year; if oftener—as in the cow, the ewe, the sow, &c.—the common

circumstances and purposes in domestic economy cause that this relation is obscured, either by the fact that the animals are immediately fecundated, or the maturation of the ova is prevented or retarded by lactation. This is the reason why the very remarkable analogy offered by the cow has, for the most part, remained unnoticed. As to the researches of anatomists and physiologists, they have but recently made any correct observations, being previously deluded by false theories. "The proper opportunities for observation on the human female were rare; menstruation, the maturation and discharge of ova, is usually so dependent on the general health that the disturbance of it nearly always precedes death. It is only after death by violence that we can hope, in healthy persons, on dissection, to make observations bearing upon this subject."

I have thus given, at much length, the arguments founded upon his experiments, of this ablest of physiological experimenters, Bischoff. Now, these arguments and experiments are to prove: 1st, that the periodical heat in the lower animals was connected with, caused by, the periodical maturation and discharge of a Graffian vesicle, an ovum or ova, and the formation of a corpus luteum, and this independent of coitus; 2d, to prove that the menstrual period in the human female was analogous to this heat period in animals, and, consequently, that the menstrual hemorrhage was not only coincident with, but dependent upon, caused by, the periodic maturation and rupture of

vesicles, discharge of an ovum; 3d, to show that the capital act of menstruation was ovulation, while the menstrual flow was a concomitant only. And all these points we conceive he has abundantly, almost superabundantly, proven; and, as these points embrace fully the matter in controversy before the Society, I might leave the argument with Professor Bischoff; but, lest some should hold to the time-honored views of periodic uterine engorgement for the purpose of nourishing a future fœtus, &c., we shall, at the risk of being tedious, proceed with other proof.

Dr. Robert Lee, the distinguished Professor of Midwifery, London, so early as 1840, says: "There are certain facts which seem to prove that it is to ovarian, and not to uterine, influence we are to attribute all the changes which take place in the female pelvis, mammæ and uterine system at the period of puberty, and that it is to certain changes in the Graffian vessicle all the phenomena of menstruation are to be refered." In proof that menstruation is ovulation, he gives a number of dissections of women dying during the menstrual epoch, in all of whom recent ruptures of Graffian vesicles were observed. In further proof of this view, he refers to the published observations of Cruickshanks; also, to cases given in Robert Hooper's large work on Morbid Anatomy.

We next quote Dr. Rudolph Wagner, Professor in Goettingen. In his great work on Physiology,

"Handwarterbuch der Physiologie," after having shown that the menstrual period in the human female is analogous to the oestrual in animals, says: "If this be the case, then are we forced to the conclusion that it is connected with, and dependent upon, the maturing and casting off of an ovum, as experiment upon the living animal demonstrates this to be the accomplished fact in the oestrum of animals. And, since the works of Pouchet, Raciborski and Bischoff on the co-existence of menstruation and the rupture of vesicles and the formation of corpora lutea; and, since the contemporaneous writings of W. Jones, Lee, Patterson, Montgomery, and others, it has become an established fact that the time of menstruation coincides with the maturing and bursting of a Graffian vesicle. In every case where a married or unmarried woman died during or soon after menstruation, there was found, on dissection, a fully matured or already broken follicle. The labors of Eker, Janker, Ritchie, Arganti, Serres, Hyrtle, Locatelli, Latheby, Coste, H. Heckel, Hainold, Garloch and Dalton confirm this fact."

He further says: "The maturation and casting off of an ovum is independent of the influence of the male sperm, as is proved by cases of occlusion of the Follopian tubes by disease or ligature, and by cases of imperforate Hymen." He leaves it an open question whether the ovum is thrown off at the beginning, during, or immediately after, the menstrual flow. And this, we will here add, doubtless,

happens both immediately before, at the commencement, during, or after, the flow, this depending upon many conditions easily accounted for. And, as we have found that, while the law is, that this maturation or bursting of the vesicles produces the entire phenomena of menstruation, with the menstrual flow, such is not always, or necessarily, the case, as in those cases of conception where a menstrual flow had never taken place. Nor do we see any objection to the supposition that, in its operation, this law may meet an exception in a reverse direction—that is, that, after having excited the concatenation, usually resulting in the menstrual flow, the menstrual exciting vesicle may not rupture at all, but take on a retrograde movevent. And, could a single case, or a few rare cases, of this nature be cited, it would be no greater argument against the ovulation theory than the occasional existence of tubal or abdominal pregnancy is against the uterus being the natural place for fœtal development.

But what was at the time of most interest in this varied research and conclusive argument of the learned and philosophical Wagner, was his citation of cases that had been long inferred, but not proven, in which the ovum in the Follopian tubes of the virgin human female, following menstruation, had been actually discovered. The indefatigable Bischoff had seen the ruptured vesicles and corpus luteum; but failed in what he was so anxious to do—to discover the ovum itself. Now, while scores of able ob-

servers had placed the coincidence of the menstrual flow and the maturation and rupture of a vesicle beyond reasonable doubt, it was not generally known that the ovum had been actually discovered. And that it should have been discovered at all is rather surprising, as it is of almost microscopical size, and about the time of its escape the Follopian tubes are filled with blood, and the lining membrane of the uterus engorged, corrugated and bloody. Wagner, however, refers us to several cases where it had been discovered. The first is given by Hyrtle, in his Anatomy of Man, in which he states that he has found the ovum in the Follopian tubes of a girl 15 years of age, who died during her first menstruation. Two more cases are referred to by Wagner, published in the Philosophical Magazine, 1851, Vol. II, No. 11. In both cases the Hymen was intact. The girls died during the menstrual flow." Since then several other cases have been published.

Dr. Fleetwood Churchill, in his classical work on Midwifery, endorses the ovulation theory, and, after summing up numerous cases from various authors, "*all of whom*," he says, "agree that in the female, during or soon after menstruation, a small, irregular rupture was found in the ovarium, and that this communicated with the remains of a ruptured Graffian vesicle." From all this evidence we are obliged to conclude that there is a periodical ovulation of Graffian vesicles, and that this occurs at a menstrual period. In support of this view his American Editor, Dr.

Condie, cites a number of cases from different authors.

Dr. Bedford, Professor of Obstetrics in the University of New York, in his work on diseases of Women and Children, says: "The reason why the physiological function of menstruation does not exist before puberty is, that the *organs of which it is the function* have no physiological existence previous to this time. These organs are the ovaries, the essential and only organs of generation, strictly so-called, in the female. The development of the ovaries occur at the period of puberty, and then it is their physiological action commences. At this time you will observe on their surface the Graffian vesicle, this latter containing the ovule which I have told you escapes ordinarily with the menstrual blood. As these ovules on the surface become matured, the *ovary itself forms the centre of a sanguineous afflux*, a veritable congestion, in which the Follopian tubes and the uterus participate. This congestion results in the escape of mucus and of blood, which passes from the uterus into the vagina, and thence escapes externally—and this is menstruation. But why is this function of menstruation periodical? If you examine an ovary in its congested state, you will observe on its surface the matured ovule of which I have spoken, or at least the ruptured vesicle from which it had escaped; examine this organ still more closely and you will find imbedded in the subjacent tissue other ovules which are not matured, but which, as they approach the

surface of the ovary, become so precisely as did the first. So in this way there is, at each monthly crisis, a constant succession of ovules to be observed, which either become fecundated by the seminal fluid of the male, or, in the absence of such influence, escape with the catameneal fluid. This periodical maturation of the ovules continues from puberty to the cessation of the menses. Previous to puberty the ovaries are undeveloped, have no action; after the function has ceased they become atrophied. This similarity of condition of the ovaries before and after the child-bearing age is explained in this way—*menstruation is, as it were, but the result of the ripening of the ovules*, which the female furnishes as her part in the great work of increase.

"The reason, therefore, that her ability to perform this latter duty is restricted to certain limits, is because it is only within these limits, from the period of puberty to the cessation of the menses, that the ovaries are capable of secreting ovules."

Surely this is sufficiently explicit. The whole vuestion in controversy is fully stated and entirely accorded us—1st. The cause of the periodic orgasm is stated to be in the ovaries—ovulation; 2d. The menstrual flow the *result*—a concomitant only---a secondary result: as, first, we have ovarian excitement, which is periodical, secondly, a resultant engorgement of the uterus, and, as the result of this, the menstrual flow. Menstruation is considered, stated, by Dr. Bedford to be the physiological action

of the ovaries---ovulation. And, as this is not a question of thought, but of direct observations, the matured opinions and extensive observations of such a man can not be ignored.

Dr. Hodge, Professor of Obstetrics in the Pennsylvania University, without arguing the question, assents to the theory of ovulation as an established physiological fact.

Prof. Miller, of the Louisville University, in his work on Midwifery, says: "In the human female ova are matured and emitted at the menstrual period, between which and the incalescence of the inferior animals there are many points of resemblance. Ovulation may be performed in exceptional cases without the menstrual flow; but *menstruation* (the menstrual flow) *is so closely dependent upon the ovaria that if they be wanting or dormant it is suppressed.* Nor is the flow of blood from the uterus the only or principal phenomenon at the ovular epoch. Important changes take place in the uterus; it becomes engorged, turgesent, so that the opposite sides of its cavity are in contact and its membrane thrown into convolutions. In such a condition of the uterus the ovum is intercepted, caught between the mucous folds, and hindered from falling *headlong* to its most dependent part. Should it be fecundated it is in a position safest for the mother and itself; if not fecundated, it will be allowed to pass away, when the orgasm raised for its behoof shall subside."

This testimony, again, is sufficiently unequivocal.

To state that "the menstrual molimen is so intimately dependent upon the ovaria, that, if these be wanting or dormant, it is suppressed," is to give them the relation of cause and effect—the *cause*, periodical ovarian excitement; the *effect*, bloody discharge. And this is the ovulation theory. And, as Prof. Miller makes all the changes taking place in the reproductive organs of the female at and during the menstrual epoch immediately dependent upon the changes going on in the ovaries, his whole testimony is unequivocally in support of our proposition. And the large experience and extensive observations of Prof. Miller entitles his opinions to much weight on a point which, like this, is determined by experiment and observation.

Another important fact in this connection, and brought out by Prof. Miller, is this: That this uterine engorgement, with its resultant eruption of blood consequent on the ovarian orgasm, is for the well-being of the ovum, and not for the future nourishment of the fœtus—"manuring soil for the more vigorous growth of the offspring," as is sometimes taught. Such uterine conditions concern not the fœtus as a fœtus, but are necessary to the well-being of its primordial state—the ovum. Were any refutation of such antiquated, visionary opinions necessary, it would be found in the fact that girls or young women who conceive at their first menstrual epoch; and, consequently, where no such "manuring" has taken place, nor the habit of uterine en-

gorgement been established, are found to proceed in the great work of normal, fœtal development just as well as the woman whose uterus had been so "manured" by its accustomed, regular, periodical engorgments for twenty or more years.

Dr. Bennet, formerly Physician Accoucheur of the Western Dispensary of London, an acknowledged high authority, fully accepts and endorses the theory of ovulation. He says: "To Dr. Pouchet belongs the credit of having been one of the first to broach the doctrine of spontaneous ovulation as a law in the female mammifery, *and also of having established this law in the most irrefutable manner by numerous experiments, and by a close and powerful analysis of all that had been done by his fellow laborers in this field of observation.*"

"The researches to which I refer prove in the most satisfactory manner that menstruation is intimately connected with the evolution from the ovary of matured ova, which take place periodically in the virgin as well as in the married female. In the human female the maturation and evolution of ova occur at frequent intervals, and are remarked by the exudation from the uterine cavity of a greater or less quantity of blood. It is evident that the term menstruation ought to be applied to the totality of the conditions that coexist with the maturation and evolution of the ovarian vesicles."

Surely nothing can be more satisfactory than this testimony. Not speculations into the disputed do-

mains of thought or speculative philosophy, but observation, direct observation, of witnesses competent and trustworthy, the experience of men of the highest scientific attainments. And the extensive experience and enlarged observations of Dr. Bennet, first in the hospitals of Paris, afterward in London, with the matured judgment of one who has devoted a life of toil to the observation of the physiological and pathological action and condition of women, we say such a man's judgment on the observation of others tried and proved true, in his own ample experience, can be but little short of conclusive. And it will be seen that Dr. Bennet does not testify alone to the coincidence of the menstrual flow with the maturation and discharge of an ovum, but also to the dependence, connection, of the one upon the other.

Dr. C. D. Meigs, the learned and experienced Professor of Obstetrics in the Jefferson Medical College, says: "A healthy woman matures and deposits an ovum every twenty-eight days, from the age of 15 to 45, failing only during pregnancy and lactation, and sometimes not even then. The *closing stage of this maturing and depositing the ovum is attended with the discharge of a bloody fluid called menstruation.* The discharge comes from the inner surface of the uterus, which has become engorged in common and along with the ovaries."

Again, in his notes to Colombat, he says: "It seems to be universally admitted that the *substantial cause* of menstruation ought to be sought for in the condition

of the ovaries ;" and, after quoting in support of this opinion the observations and experiments of Negrier, Gendrin, Lee, P. Dubois, Bernard, Bischoff, M. Jourdan, Baer, Coste, W. Jones, Barry, Raciborski and Pouchet, whose accumulated, accorded, and almost superflously repeated demonstrations of this fact leave no reasonable doubt, he adds, "In adopting the views of these writers, I find abundant explanation of the paucity of our resources in the use of mere emenogoga, and in the efficiency of constitutional treatment of menstrual disorders, as disorders of the constitution are fully sufficient to the arrest of the ovarian travail by suspending the development of the vesicles." And he fully endorses the statement of Raciborski: "That it is an established fact that the menstrual hemorrhage is but a secondary Phenomenon in menstruation properly so-called, and that the capital act in this function consists in the maturation and the periodical discharge of the ova—the *ponte* (laying). There are women in whom it is confined to this act alone, and authenticated records furnish numerous cases where women have had several children without ever having seen the menses." Now, it is seen that in this argument of Prof. Meigs ovulation is not given as a coincidence only, but a cause—the act—while the uterine engorgment and consequent flow are epiphenomena, not necessarily but generally resultant of the egg-laying orgasm. And, as his treatment for uterine disorders are founded on this view; and, as his vast experience

and world-renowned success are demonstrative of the truth of his views, we have, in the matured opinions of the learned Professor, the highest proof of the ovulation theory of menstruation.

Dr. Dalton, in the new edition of his Human Physiology, argues this ovulation theory as one of the best established truths of physiology. He says: "In the human female the return of the period of ovulation is marked by a peculiar group of phenomena, which are known as menstruation." This is his opening sentence on menstruation. No mincing, no doubt, no gradual or cautious approach of a disputed point; but is given as an admitted fact, just as much so as the Harverian theory of the circulation of the blood, or the Copernican philosophy of the heavens, or the Newtonian theory of gravitation. And—just as he might have said, The blood, receiving an impulse from the heart, passes out through the arteries to the capillaries, thence to the veins, through which it is returned to the heart—he says, "the return of the period of ovulation is marked by peculiar phenomena known as menstruation." Here the ovulation is everything — the uterine engorgment, the heat of vagina, the weight in the pelvis, the bloody discharge, but effects marking the great act of the ovaries.

In proof of this view Dr. Dalton gives, not only the observations of others, but his own direct and positive observation of the fact. He further says; "The menstrual flow is only the *external sign* of a

more important process taking place within, and that this flow is not an absolute or necessary requisite. Provided a mature egg be discharged from the ovary at the appointed period, menstruation, properly speaking, exists, and pregnancy is possible."

Todd and Bowman, in their classical work on Physiology and Physiological Anatomy, say: "The most important of the phenomena accompanying menstruation is the maturation and discharge of ova from the ovary. At these periods a Graffian follicle becomes enlarged, projecting considerably from the surface of the ovary, and distended with fluid. Its walls become thin at one point, where it at length gives way and the contents of the follicle escape into the Fallopian tube. In animals the ovum may be detected without difficulty, although it *is only of late years that the escape of the contents of a Graffian follicle at each menstrual period has been placed beyond a doubt.*" "The discharge of ova from the ovary in animals, as in the human subject, occurs only at certain definite periods; at such a time the animal is said to be in 'heat' or 'rut.' If the ovary of the animal be examined at the time of 'heat,' it will be found turgid with blood, and several Graffian vesicles will be seen projecting from its surface, forming prominences, the most superficial portions of which appear thin and almost ready to rupture, and permit the escape of the contents of the follicle; at the same time a more abundant secretion of mucus takes place from the walls of the vagina and contiguous parts. In a few

instances, also, a bloody discharge has been detected in the vagina. It may be considered as established, that in the human female, at or about the period of menstruation, a discharge of ova takes place, and at these times the ovaries are extremely turgid, and their vascularity is much increased. From very numerous observations *it has been distinctly proved that conception is more likely to take place a few days after menstruation than at any other period.*

"From these facts *most* physiologists have been led to look upon the menstrual period in the human female as *identical* with those of heat or rut in animals.

"The maturation and escape of ova, then, in all animals is a periodical phenomenon, and even in the human subject, if not accompanied with, is shortly followed by, increased desire, while in animals sexual intercourse takes place at these times alone."

There can be no doubt here about the existence of the relation of cause and effect between the maturation and rupture of the vesicle and the menstrual flow, either in the opinions of the authors or in fact. We had insisted on the *analogy* between the oestrual period of the inferior animals and menstruation in the human female. Here, upon the authority of most physiologists, they are given as *identical.* In both there is a discharge of ova; in both this state is periodical; in both this is the time for conception; in both there is increased heat and discharge of mucus, sometimes mixed with blood; in both, at or

about this time, there are increased sexual desires.

James T. Simpson, the learned Professor of Midwifery in the University of Edinburgh, says: "That the various secondary sexual peculiarities which take place at puberty are intimately dependent upon the changes that take place at the same time in the organism of the female ovaries, seem proved by various considerations."

"When the usual development of the ovaries at the term of puberty does not take place, the secondary sexual characters which are naturally evolved in the female at that period do not present themselves."

"Many facts seem to show that the act of menstruation most probably depends upon some periodical changes in the ovaries, or, rather, in the Graffian vesicles of these organs or their contents; and, when the function becomes suddenly and permanently stopped in a woman at the middle period of life, without any indication of the catamenial fluid being merely mechanically retained, we may, perhaps, suspect, with reasonable probability, the existence of a diseased state, which has destroyed either successively or simultaneously the functions of both ovaries. In such a case the distinctive secondary peculiarities the female sex come to give place to those of the male."

Kolliker, in his learned work on Microscopical Anatomy, shows the connections between the menstrual flow and the oestrum of the inferior animals, and the periodical maturation and discharge of ova.

Dr. Ramsbotham, in his System of Obstetrics, says: "Dr. Letheby has detected the ovum in the tube in two unmarried girls who died during menstruation. Thus has been confirmed the suspicion so long entertained that, in the human female, the maturation of ova and their discharge from the ruptured follicles take place periodically, at the epochs of menstruation."

There is, perhaps, no higher authority upon this subject than P. Cazeau, whose great work on Midwifery has been placed, "by the European Council of Public Instruction of Paris, among the classical works of France." We quote from this work:

"Before the age of puberty the surface of the ovaries is of a light, rose color, and is smooth and free from irregularities. In women who have menstruated for several years the surface is rough, fissured, covered with small, black cicatrices, and sometimes with ecchymotic spots." "Until the age of puberty the Graffian vesicles are of small size, and concealed in the centre of the stroma; but, at this epoch, some fifteen or twenty of them, which appear more advanced than the others, increase in size and approach the external surface of the ovary. At the time when the young girl becomes nubile, one of the latter vesicles seems to have received a great increase of vitality; it undergoes a remarkable hypertrophy, and forms a projection upon the surface of the ovary; this projection becomes greater and greater until, after some days, it forms a tumor of the size of a

cherry, or even of a small nut, upon the ovarian surface. When at last it has arrived at its full development, the ovarian capsule appears to remain stationary, until an over exertion, produced either by the maturity of the ovule or by sexual intercourse, occasions its rupture."

"The evolution just described, which is terminated by the rupture of a vesicle and the spontaneous expulsion of an ovule, is not an isolated fact; on the contrary, it excites numerous sympathies in the remainder of the generative apparatus and throughout the organism of the female."

"The *ovary* which produces the hypertrophied vesicle is notably enlarged. It is of a deep, red color, and its vascular apparatus is remarkably congested. The *Fallopian tube* itself shares in the congestion, being often of a violet, red color, especially at its fimbriated extremity, which has a sort of velvety appearance. It is also endowed at this epoch with a special erethism, in virtue of which it applies its floating extremity upon the ovary in such a manner as to secure the ovule and to conduct it into its cavity."

"The *uterus undergoes such important changes that, before the discovery of spontaneous ovulation, it was erroneously supposed to play the principal part in the phenomena we are about to study.* While the ovarian vesicle is undergoing the rapid evolution which we have first described, the vascular apparatus of the womb becomes developed and injected in a remarkable

manner. The entire volume of the organ is increased, the neck is tumified, and its orifice narrower; the lips of the os tincæ are warmer and their color deeper, and its mucous membrane so much engorged by the development of its vessels and glands that it is thrown into folds or circumvolutions, which are so pressed together as to leave no vacant space in the organ.

"This great vascularity of the mucous membrane, and the high vascularity which the entire organ undergoes, is at first accompanied with the exudation of a few drops of blood, which, by admixture with the vaginal mucus, which is itself, at this period, increased both in quantity and fluidity, gives it at first a very thin and bright reddish hue; after two or three days a flow of blood, derived principally from the superficial network of the mucous membrane, takes place, escapes through the neck—mingles with the vaginal secretion. Henceforth the effusion presents all the characters of a true hemorrhage.

"It is impossible, in the present state of our knowledge of the subject, to determine precisely at what moment during the flow of blood the rupture of the Graffian vesicle takes place. The result of numerous autopsies admit of the supposition that this moment is variable, *and the curious experiments of M. Coste leave no doubt whatever as to the influences which venereal excitement is capable of exerting upon it. This influence is so great that it may determine the rupture of an hypertrophied vesicle which, without sexual intercourse,*

would have remained intact for several days longer. However, it may be admitted as a general rule that the rupture occurs during the last days of the flow.

"The series of phenomena of which the ovary is the seat is not terminated by the rupture of the vesicle." Here follows a description of the *corpus luteum*, which the author justly states to be formed by an effusion of blood into the ruptured wall of the Graffian vesicle, and to follow, as a law, every menstruation, regardless of conception or coitus. This law, as we have seen, may, like all other general laws, meet an occasional exception in its operation. For instance, the enlarged vesicle may be ruptured some days, perhaps ten or fifteen, before the time of its spontaneous rupture, by the stimulus of coitus be impregnated and the menstrual flow thus prevented. In this case the *corpus luteum* formed would be known as a *true corpus luteum* differing in no particular from those following menstruation, except that, the local engorgement being more persistent, the *corpus luteum* is better developed, more persistent, or it may happen, as stated in another place, that the Graffian vesicle, after through its maturation exciting, as our author truly says it does, the secondary phenomena with the resultant menstrual flow, may finally undergo degeneration and not rupture, discharging an ovum, at all.

Cazeau continues: "Toward the age of puberty the ovary becomes the seat of an active congestion, and, it might be said, of a new vitality; all the liv-

ing powers of the organ seem to be concentrated on one of the Graffian vesicles, which suddenly assumes a considerable development, and in so doing raises the envelope of the ovary and forms a tumor, which is superadded to the organ. The walls of the vesicle become weaker and weaker as their distension increases, until they finally give way; in consequence of the rupture the ovule is expelled, and carries with it a portion of the granular fluid with which it was surrounded. This expulsion constitutes the phenomenon known of latter times as *spontaneous ovulation.*

"As accessory phenomena, it is known that the uterus and its annexes participate to a greater or less degree in the ovarian activity. Our attention should be directed to the great resemblance between this succession of physiological acts and the series of phenomena which comparative physiology and anatomy have shown to take place in mammalia at the rutting season. In them, likewise, the approach of the male is not necessary to the discharge of the ovule, and the spontaneous ovulation is accompanied with almost identical changes in the genital organs, and manifests its influence upon the entire organism by the same assemblage of phenomena. In the human female, as in mammalia and birds, the spontaneous ovulation, accompanied with the same cortege of symptoms, occurs at more or less regular intervals. In the rabbit it is a tumefaction and almost varicose injection of the vulva. Finally, in the monkey a more or less abundant hemorrhage occurs,

which, in the case of the macaquæ and the cynocephalae, coincides with a monstrous swelling of the vulva.

"The vesicular evolution, accompanied with the array of phenomena just described, is repeated at intervals, which vary with different animals; but in the human female recurs at much shorter intervals. Every month, in fact, in the normal condition a new Graffian vesicle is found to increase in size, to become excessively distended, and finally bursting and discharging the ovule, to become the seat of successive transformation presented by the corpus luteum. Every month, therefore, this curious phenomenon of spontaneous ovulation is renewed, and the dark-colored cicatricula of various forms which are observed upon the surface of the ovary of nubile women give rise to the supposition, exclusive of direct observation, that the operation of which they are the consequence must have recurred a great number of times.

"Of the phenomena which we have just described, the flow of blood had, until of late years, chiefly claimed attention. *This flow, as well as the vesicular evolution of which it is the consequence*, occurs for the first time between the ages of twelve and fifteen years. This periodical excretion constitutes menstruation a phenomenon, which, though doubtless of importance, is nevertheless far from being the *capital fact* amongst those which we have studied, for it may be absent without the ovular changes being notably

affected thereby, whilst, on the other hand, it never appears without having been preceded and accompanied by the development of a Graffian vesicle. *It* (the menstrual flow) *is, therefore, a secondary phenomenon, intimately connected with those which are accomplished in the ovary.* Its first appearance, *which is always determined by the ovarian evolution, of which it is one of the epiphenomena*, reveals the aptitude of the female for fecundation."

In proof of our statement, that no matter at how early an age a child's Graffian vesicles matured and ruptured, she would then menstruate, Cazeau says: "Rejecting many cases of precocious menstruation, there are some whose genuineness is undoubted, inasmuch as the appearance of the discharge was attended with all the attributes of puberty. Thus Dr. Susewind knew of a child of seventeen months which had menstruated since she was a year old, the hemorrhage returned regularly every month, and the breasts and mons veneris were those of a girl of fourteen or fifteen years old. The child observed by Lenhossek menstruated when nine months old, and at two years she presented all the external signs of puberty. The girl mentioned by D'Outrepont, who had four teeth when two weeks old, was regular from the age of nine months. She had at that time long, black hair and prominent breasts. A woman observed by Carus menstruated when two years old, became pregnant at eight, and died at an advanced age."

"These premature menstruations are certainly due to the same causes which determine their appearance in most women about the age of fifteen years. Being always accompanied by the development of the breasts and the other marks of puberty, *they are the evidences that, under the influence of an anomalous vitality of the ovaries, the Graffian vesicles have undergone a very precocious development.*

"Few questions have given rise to more lively discussion than the *cause* of menstruation. I think it is useless, however, to mention here the numerous and more or less whimsical hypotheses which have successively appeared in reference to it. The fact is, that after having read all that has been written on the subject, the mind rests satisfied in its ability to refer this singular phenomenon to one unchangeable and *easily verified fact,* namely, *the successive evolution of the Graffian vesicles.* We owe this satisfactory explanation to the admirable labors of Negrier, Coste, Pouchet, Raciborski, Robert Lee and Bischoff.

"*That the cause of the menstrual discharge is the evolution of a Graffian vesicle* would be an indisputable proposition, provided we were able to show—1st. That the examination of women who died during or shortly after the menstrual period had uniformly revealed the above-named changes in the ovary; 2d. That the absence of ovaries involved of necessity the absence of menstruation; 3d, and lastly, That there is a complete analogy between the anatomical and physiological phenomena of the heat of animals, and

those which accompany menstruation (the menstrual flow) in the human female." And all these propositions Cazeau thinks can be, and are, established beyond reasonable doubt or successful contradiction. In proof of the first he says: "1. Since attention has been directed to this subject, no one has succeeded in instancing the case of a single woman who died at the menstrual epoch, whose ovary did not present a vesicle in a greater or less degree of development, or else one which had been already ruptured. The facts related by Coste, Negrier, Pouchet, Raciborski, and others, are now too numerous to reproduce in a work like the present. I myself might add, if necessary, a considerable number of cases to the others. This universal coincidence affords, at the very outset, a very strong probability of the relation of causality, which we wish to establish; but it would become an absolute certainty were it possible to prove that the absence of the ovaries involved of necesity the absence of the menses." And this, Cazeau thinks, has been done—first, by experiments on animals, when it is found that the removal of the ovaries destroy forever all symptoms of heat; and, second, in instances in the human female where the ovaries were absent or had been removed, as in Potts' case, or in the Padjeras of Asia examined by Dr. Roberts. But this has been fully shown in our second argument.

"3. Admitting, finally, the incontestible analogy between the symptoms of heat and menstruation, it will be sufficient to prove, in order to deduce there-

from a favorable argument, that the former is always connected in animals with ovarian evolution. Now certain experiments do not allow of hesitation. By these it is in fact proved (Coste) that the females never enter heat except when the preparation for the spontaneous evolution is going on in the ovaries. Menstruation is, therefore, intimately connected with the evolution of the ovarian vesicles, *and it can not occur without it; and every time that it appears we may feel entirely satisfied as to the existence of the vesicular development.* But, as an additional phenomenon, the uterine hemorrhage may be wanting without hindering in any degree the regular march of the process going on in the ovary. In a word, the spontaneous ovulation, which ordinarily gives rise to an exhalation of blood from the internal surface of the womb, may have its influence restricted to the ovary alone, and to assume the non-appearance of the menses as a ground for denying the aptitude for conception would be incurring the risk of frequent deceptions. Thus it happened that science possesses numerous examples of young girls who became pregnant before they ever had menstruated, as also of women who had conceived, notwithstanding a suppression which had lasted for several months..

On the other hand, Cazeau mentions what we have already stated, that the menstrual flow does not always and necessarily imply that the matured follicle had actually ruptured, discharging its ovum, as, after having established the movement by its evolu-

tion, the matured vesicle may remain stationary for some time, and finally abort without rupture. Now, in such a case as this, how long is it possible for this menstrual, exciting, stationary vesicle to retain its vitality? May we not suppose the stimulus of coitus could cause its rupture, and that it might be fecundated at any time previous to the next menstrual period!

We have given at much length Cazeau's views—first, because our sixth argument appeals to authority; second, because no human testimony can be of more importance upon this subject than Cazeau's; and lastly, because of the lucid and conclusive manner in which he has treated it.

In contending for the maturation and discharge of an ovum in the human female at well defined and regular periods—say every four weeks—as a general law, and this independent of coitus, we would not be understood to assert that such maturation and discharge can not take place at any other time. To the contrary, we find it occurring in some women every three weeks or oftener, in others not oftener than every six weeks. Indeed, knowing the influence of disturbing forces upon our organism, it would be perhaps impossible to suppose that this alone should move on with unerring determination to the excitation, induction and conduction of a uniform concatenation of phenomenon, consequently we are prepared to admit, indeed expect, that a menstrual, exciting, Graffian vesicle may produce the uterine engorge-

ment and consequent flow even before its full maturation and discharge, which may not actually happen for some ten or fifteen days afterwards. And even then be produced by the erethism of coitus, or that its maturation and discharge might happen with the production of so little sympathetic disturbance that the flow should not be produced thereby, or that a protruding vesicle, though not fully matured and ready to drop as ripe fruit from its stem for yet ten or fifteen days, may yet be viably matured and caused to rupture, discharging its ovum, by the orgasm of coitus, just as a fœtus that would not be fully matured in a less time than nine months may yet be cast loose and live at seven months. For this reason, while it might not be advisable for a woman desiring offspring to have connection with her husband only at a time midway between her catamenial period, yet it might not be safe for one who did not wish to conceive to have connection at such time.

There is another reason why a woman, regular every four or six weeks, might conceive at a time remote from such period, which is, that the male spermatozoa, under favorable circumstances, live for an unknown time after ejection, and under favorable circumstances the female germ lives an unknown time after the rupture of the vesicle and its discharge from the ovary, and, for all we know to the contrary, these might meet in the Fallopian tubes, and fecundation take place many days, possibly twelve or fifteen, after such ejection and discharge. That such is not

the usual condition, conception most generally taking place within perhaps a few hours after coitus, we readily grant, and would only insist upon so great a time as a possible phenomenon, which in our present state of knowledge can not be certainly established or disproved. But this suggestion is not the mere, unfounded supposition of a conceivable possibility, but derives support from the general belief of physiologists and embryologists, that fecundation of the ovum is possible at any time during its passage through the Fallopian tubes—that is, at any time previous to its arrival at the uterus, or even in the womb This latter may be possible, but the fecundated ovum would be lost, and pregnancy would not follow. Now, granting that this view is correct, that conception and pregnancy are possible at any time during the passage of the ovum through the tubes, then the supposed *possibility* of conception taking place twelve or fifteen days after its discharge from the vesicle becomes a *probability*, if not an absolute certainty, as direct experiments upon the inferior animals prove that a time; varyging in different animals, of many days is required for the passage of the ovum through the tubes. In the rabbit it remains in the tubes three days, in the rodentia from four to six days, and that of the bitch for eight or ten days; while in the deer the ovum requires for its passage through the tubes into the uterus, according to Bischoff and Dr. Ziegler, several months. And without granting so great a time as the latter in the human

female, it is altogether reasonable to suppose, with Bischoff, it may be fecundated ten or twelve days after its discharge. Now, to add to this the demonstrated fact that it may not, often is not, discharged until four or six days after the menstrual flow, and we have conception at any time between the periods reduced to a normal condition. So that conception taking place at any time, such as twelve or fifteen days before or after the menstrual flow, indeed at any point of time between the menstrual periods, is no argument whatever against the theory of ovulation.

In this viability of the ovum, and possibility of its being fecundated during its passage through the tubes, we have the explanation of the fruitfulness of the Jewish women, in despite of their religion, which forbids sexual connection until *six* days after the flow; and the Mohammedan women, whose religion forbids such connection until *eight* days after the flow. Here nature in her *latitude* and the *plenitude* of her provisions for the preservation of the species stretched beyond the ignorance and superstition of law-makers.

And while, as a great general law, the human female begins to mature and cast ova at fifteen years, and continues to do so for thirty years, or until forty-six years of age, yet she may mature them as early as three or five years, and the process may cease before she arrives at thirty-five, or continue until sixty or seventy years of age.

But so much are we what we are, not because of our organism alone, but thus impressed, modified, by

our surroundings, that while women in temperate and hot climates may begin to menstruate, mature and deposit ova at nine years of age, and continue regularly to do so some thirteen times a year during their entire menstrual era, in Arctic regions they do not usually commence before eighteen or twenty years of age, and then often menstruate only three or four times a year. During their long, cold, dark seasons, the females of Lapland rarely menstruate oftener than every eight or twelve weeks, and then the ovulation is attended by, productive of, a much less external discharge (hemorrhage) than with their more salacious, more fruitful sisters of the tropics. With animals as with plants, warmth and moisture favor reproduction, promote ovulation. So much is this the case that animals and plants that reproduce but once a year in cold climates, do so as often as twice or three times in hot ones.

But while it has been seen that the menstrual flow, or hemorrhage, is but an epiphenomenon, an important, but by no means a necessary, concomitant of the menstrual epoch, which may be, and often is, absent without detriment to the economy or loss to the true object of menstruation—reproduction of the species, such is not the case with the true menstrual function, ovulation, as the loss of this necessarily involves the loss of the species. And so entirely is the great work of the reproduction of the species made the end and aim of of the female organism, that every charm which she possesses, either physically, morally or

mentally, is the result of her ovarian force. It is this that builds, or has built, the mammæ, expands both pelvis and chest, softens the voice, arouses the dormant uterus, and throws around the female organism that symmetrical outline characteristic of the full physical perfection of woman. Hence no stroma force, no sexual development, no sexual moral feelings or psychological manifestations. Without this ovular force the reproductive or sexual orgasm remains unknown, does not exist, and the female remains a child in mind as well as in physique, without any more idea of the force or poetry of love than one born blind has of color. Hence, organism makes mind or soul, or this is the differentiated force of organism!

With this materialistic view of this materialistic subject, we have removed from this important function—important because necessary in the reproduction of the species—all the metaphysico-theologicum mystery, which ignorance and superstition alike combined, had thrown around the reproduction of the species, the formation of humanity. As by this it is seen that man, like the acorn or the tadpole, is the outgrowth of a primordial embryo cell, which is the product of the union of two opposite sexual cells. That the female furnishes as her part of the great work of reproduction germ cells, eggs, one of which is matured and laid every twenty-eight days, which laying is usually announced by certain symptoms called menstruation. That this egg possesses, most

likely, the constructive material of the organism, and, by union with the sperm cell of the male, has imparted to it the constructive, dynamic, energy of the organism, whereby like, from inexorable necessity, builds up like, could not, under the present condition for which alone it is adopted as a law, build up any other than a like organism, as it possesses only the necessary conditions for this, and the means provided for the union of the cells are just such as inexorable necessity requires from the habits and habitats of the animal. In the fish, where the germ cells are deposited in the water and the male sperm cells in the surrounding fluid, the chances that any two cells shall come in contact are very small. Here the superabundant quantity is exactly as the chances of such union, together with the chances, again, that such fortunate embryo cell will, under its unfavorable surroundings, be developed into a full-grown fish; and, as these make the probabilities almost infinitesimal against any individual egg becoming a full-grown codfish, all these are met by the *nine millions* of such eggs deposited by the fish. Now, in the mammalia, the adapted organism and its surroundings are such as to bring the probabilities of any such individual egg much closer; and here the number of such germ cells are much less. Finally, in humanity, the adapted organism and its resultant psychological forces are such as to render this probability comparatively almost a certainty, and here but one egg is prepared at a time. Yet, even

here the probabilities are decidedly against any individual egg; consequently, lest the perpetuation of the species might be jeopardized by this paucity in numbers, the time of laying is reduced from once a year to every twenty-eight days. Now, when understood, as we see it may readily be, and when deprived as it thus is of the unnecessary mystery which has been designedly or ignorantly thrown around it, generation or the reproduction of the species, even of the highest known as man, is no more monstrous, miraculous or mysterious than respiration, nutrition, or indeed any other vital phenomenon.